PATENT ABSTRACTS OF JAPAN

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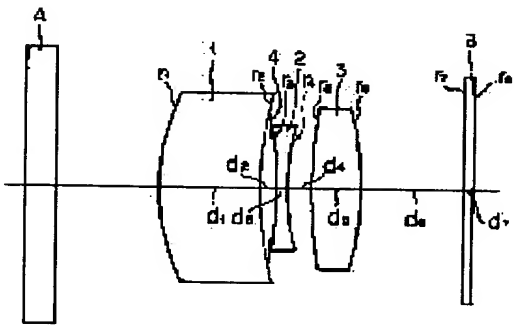
(54) LENS FOR READING COLOR ORIGINAL

(57)Abstract:
PURPOSE: To provide a new type of lens for reading color image in which miniaturization and a low cost can be attained and chromatic aberration can be corrected satisfactorily.
CONSTITUTION: In this lens system, first to third groups are arranged sequentially from an object side to an image sie, and it is composed of three groups/three lenses provided with a diaphragm 4 between the first and second groups, and the first group 1 is composed of a meniscus lens whose convex surface is made to face the object side, and the second group of a biconcave lens, and the third group of a biconvex lens, and conditions (1) 0.83<f1/f<0.88, (2) 0.30<|f2/f|<0.33, (3) 0.10<(N1+N3)/2)-N2<0.13, and (4) 16<((□1+□3/2)-□2< 18 can be satisfied assuming the focal distance of the whole system, the first group, and the second group for line (e) as (f), f1, and f2, respectively and the refractive index of material of a j-th group (j=1-3) as Nj, and Abbe number as □j.



LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] It is a three three groups configuration which comes to allot the 1st thru/or the 3rd group from a body side one by one toward an image side, and has drawing in between groups [1st and 2nd]. f, f1, f2, refractive-index:Nj of construction material of the j-th group (j=1-3), and Abbe number:nuj A focal distance of the whole system and the 1st and 2nd group : Conditions (1) [as opposed to / a biconcave lens and the 3rd group of a convex meniscus lens and the 2nd group by which the 1st group turned a convex to a body side are biconvex lenses, and / e line] 0.83<f1/f< 0.88 (2) 0.30<|f2/f|<0.33 (3) A lens for color copy reading characterized by satisfying 0.10<{(N1+N3) /2}-N2<0.13(4)16<{(nu1+nu3) /2}-nu2<18.
[Claim 2] Synthetic focal distance:f of the whole system [on a lens for color copy reading according to claim 1 and as opposed to lens system overall-length:dT and e line] is conditions (5). A lens for color copy reading characterized by satisfying 0.25<dT/f<0.26.
[Claim 3] It is a three three groups configuration which comes to allot the 1st thru/or the 3rd group from a body side one by one toward an image side, and has drawing in between groups [2nd and 3rd]. f, f1, f2, refractive-index:Nj of construction material of the j-th group (j=1-3), and Abbe number:nuj A focal distance of the whole system and the 1st and 2nd group : Conditions (1') [as opposed to / a biconcave lens and the 3rd group of a convex meniscus lens and the 2nd group by which the 1st group turned a convex to a body side are biconvex lenses, and / e line] 0.93<f1/f< 1.06 (2') 0.28<|f2/f|<0.32 (3') 0.11<{(N1+N3) /2}-N 2< 0.13 (4') A lens for color copy reading characterized by satisfying 15<{(nu1+nu3) /2}-nu2<18.
[Claim 4] Synthetic focal distance:f of the whole system [on a lens for color copy reading according to claim 3 and as opposed to lens system overall-length:dT and e line] is conditions (5'). A lens for color copy reading characterized by satisfying 0.23<dT/f<0.27.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the lens for color copy reading.
[0002]
[Description of the Prior Art] "Manuscript read" which signal-izes a manuscript with a solid state image pickup device is widely performed in facsimile apparatus, a digital copier, etc. from the former. These days, small and low-pricing of these equipments follow on being meant, and the thing of small and a low price is called for also for the lens for manuscript reading used for manuscript read.
[0003] Moreover, in order to perform read of a color copy with such an element, amend the chromatic aberration of the lens for manuscript reading good, and the best image formation side of each light of red, green, and blue is made in agreement with an element light-receiving side, and although the "three-line 1 chip CCD" which put side by side the solid state image pickup device of three lines which had the filter of red, green, and blue although a color copy is separated the color of and read on 1 chip is generally used, if it is ****
[0004] As a lens for manuscript reading constituted from a "triplet mold" effective in a miniaturization and low-cost-izing of a lens system, although the thing given [for example,] in JP,4-255814,A is known, this lens is not taken into consideration about chromatic aberration, therefore does not fit the read of a color copy.
[0005]
[Problem(s) to be Solved by the Invention] This invention is made in view of the situation mentioned above, and aims at offer of the new lens for color copy reading which amended chromatic aberration good by small and the low price.
[0006]
[Means for Solving the Problem] A lens for color copy reading according to claim 1 is a triplet mold as shown in drawing 1 , it comes to allot the 1st group 1 thru/or the 3rd group 3 from a body side one by one toward an image side, extracts it between the 1st group 1 and the 2nd group 2, and has 4. A biconcave lens and the 3rd group 3 of a convex meniscus lens and the 2nd group 2 by which the 1st group 1 turned a convex to a body side are biconvex lenses.
f1, focal distance:f2 of the 2nd group 2, focal distance (synthetic focal distance):f of the whole system, refractive-index:Nj of construction material of the j-th group (j=1-3), and Abbe number:nuj A focal distance of the 1st group 1 : Conditions (1) $0.83<f1/f<0.88$ (2) $0.30<|f2/f|<0.33$ (3) $0.10<\{(N1+N3)/2\}-N2<0.13$ (4) $16<\{(nu1+nu3)/2\}-nu2<18$ are satisfied. However, all of Above f1, f2, f, and Nj and nuj are the values over "e line."
[0007] Synthetic focal distance:f of the whole system [on a lens for color copy reading of the claim 1 above-mentioned publication and as opposed to lens system overall-length:dT and e line] is conditions (5). It is desirable to satisfy $0.25<dT/f<0.26$ (claim 2).
[0008] A lens for color copy reading according to claim 3 is a triplet mold as shown in drawing 2 , it comes to allot the 1st group 1 thru/or the 3rd group 3 from a body side one by one toward an image side, extracts it between the 2nd group 2 and the 3rd group 3, and has 4. A biconcave lens and the 3rd group 3 of a convex meniscus lens and the 2nd group 2 by which the 1st group 1

turned a convex to a body side are biconvex lenses. When a focal distance of the 1st group 1, a focal distance of the 2nd group 2, a synthetic focal distance of the whole system, a refractive index of construction material of the j-th group, and the Abbe number are set to f1, f2, f, Nj, and nuj to "e line" also in claim 1, respectively, similarly these Conditions (1') 0.93<f1/f< 1.06 (2') 0.28<|f2/f|<0.32 (3') 0.11<{(N1+N3) /2}-N 2< 0.13 (4') 15<{(nu1+nu3) /2}-nu2<18 are satisfied.
[0009] Synthetic focal distance:f of the whole system [on a lens for color copy reading according to claim 3 and as opposed to lens system overall-length:dT and e line] is conditions (5'). It is desirable to satisfy 0.23<dT/f<0.27.
[0010] In addition, in Sign A, in drawing 1 and 2, manuscript installation glass and Sign B show cover glass on a light-receiving side of a solid state image pickup device.
[0011]
[Function] The lens for color copy reading of this invention is the "triplet mold" of three groups [three] as mentioned above. Claim 1 and the lens for color copy reading of two publications differ in the location of "drawing" from claim 3 and the lens for color copy reading of four publications mutually. A parameter [in / according to this difference / a monograph affair type]: The range of f1/f, |f2/f|, {(N1+N3) /2}-N2, {(nu1+nu3) /2}-nu2, and dT/f is a different thing a little.
[0012] Conditions (1) and (1') are "conditions by which the power of the 1st group is provided" in each of claim 1 and the lens for color copy reading of three publications, and if the maximum of these conditions is exceeded, since the positive power of the 1st group will become small too much, it becomes difficult for a lens overall length to become large and to meet the request of a miniaturization of a manuscript reader. Conversely, although the positive power of the 1st group becomes large and is advantageous to miniaturization of a lens overall length if a minimum is exceeded, distortion aberration and comatic aberration get worse, and aberration amendment becomes difficult.
[0013] Conditions (2) and (2') are "conditions by which the power of the 2nd group is provided" in each of claim 1 and the lens for color copy reading of three publications, if the maximum of these conditions is exceeded, since the negative power of the 2nd group becomes small too much, the PETTSU bar sum will become large and amendment of astigmatism will become difficult. If a minimum is exceeded, the power of each lens will become large, it will become easy to generate high order aberration, and comatic aberration will occur.
[0014] Conditions (3) and (3') will be "conditions by which the relation of the refractive index of a convex and a concave lens is provided" in each of claim 1 and the lens for color copy reading of three publications, if the maximum of these conditions is exceeded, the PETTSU bar sum becomes small too much, the image surface will fall on a positive side and a curvature of field will become large. if a minimum is exceeded — the PETTSU bar sum — large — becoming — passing — a negative-in the image surface side — falling — the astigmatic difference — being large . therefore, conditions (3) and (3') — being out of range — if — the engine performance with whole surface each good ****** — it cannot obtain .
[0015] Conditions (4) and (4') are "the conditions for amending chromatic aberration good" in each of claim 1 and the lens for color copy reading of three publications, if a maximum is exceeded, it will become superfluous amending the chromatic aberration on a shaft, and the chromatic aberration on the shaft by the side of short wavelength will become large by positive to the dominant wavelength. Moreover, if a minimum is exceeded, the chromatic aberration on the shaft by the side of short wavelength will become large by negative to the dominant wavelength.
[0016] Conditions (5) and (5') are the additional conditions over claim 1 and each lens for color copy reading of three publications, and it is [claim 1 and each lens for color copy reading of three publications] desirable respectively to satisfy conditions (5) and (5').
[0017] That is, conditions (5) and (5') are the conditions about an overall length, harnessing the feature of claim 1 and each lens for color copy reading of three publications by satisfying these conditions, amend aberration good further and become miniaturizable [an overall length].
[0018]
[Example] Hereafter, a concrete example is given.

[0019] As shown in drawing 1 and 2, it counts from a body side, and the radius of curvature of the i-th lens side and each side of cover glass B is set to ri (i=1-8), it counts from a body side, and the spacing on the i-th optical axis of a field and the i+1st fields is set to di (i=1-7). Moreover, the refractive index and the Abbe number to e line of construction material of the j-th group (J=j-3) are displayed as N4 and nu4 by making Nj, nuj, and the refractive index and the Abbe number of cover glass B into the above-mentioned suffix j= 4. Furthermore, f (unit: mm) and brightness are expressed with F/No, and it expresses [the synthetic focal distance of the whole system / a scale factor] omega (unit: degree) and the body high with Y (unit: mm) for m and a half-field angle. In addition, since manuscript installation glass A does not influence the lens engine performance, the original publication is omitted.
[0020] Example 1f=78.3, F/No=5.6, m= 0.22, omega= 19.2, Y=152.4i ri di j Nj nuj 1 24.363 10.000 1 1.77621 49.622 36.757 1.4123 -40.593 1.0 2 1.67765 32.174 27.314 1.890 5 55.614 6.006 3 1.79195 47.496 -34.893 86.4 7 infinity1.0 4 1.51633 64.148 infinity The location of drawing: Image side of the 2nd lens side Location of 0.911mm.
[0021] The value f1 of a condition value/f= 0.879, |f2/f|=0.307, {(N1+N3) /2}-N 2= 0.106, {(nu1+nu3) /2}-nu2=16.4 dT/f=0.259 .
[0022] Example 2f=78.3, F/No=5.6, m= 0.22, omega= 19.2, Y=152.4i ri di j Nj nuj 1 24.143 10.000 1 1.75844 52.302 38.631 1.7023 -41.369 1.0 2 1.63923 32.484 26.499 2.445 5 59.329 4.803 3 1.76066 48.676 -35.371 86.4 7 infinity1.0 4 1.51633 64.148 infinity The location of drawing: Image side of the 2nd lens side Location of 1.209mm.
[0023] The value f1 of a condition value/f= 0.835, |f2/f|=0.321, {(N1+N3) /2}-N 2= 0.120, {(nu1+nu3) /2}-nu2=18.0 dT/f=0.255 .
[0024] As mentioned above, examples 1 and 2 are examples of claim 1 and the lens for color copy reading of two publications.
[0025] Example 3f=78.3, F/No=5.6, m= 0.22, omega= 19.1, Y=152.4i ri di j Nj nuj 1 23.389 10.000 1 1.71615 53.942 34.573 1.3743 -39.618 1.0 2 1.62270 34.064 25.523 1.795 5 49.495 6.232 3 1.77621 49.626 -36.344 86.4 7 infinity1.0 4 1.51633 64.148 infinity The location of drawing: Image side of the 4th lens side Location of 0.857mm.
[0026] The value f1 of a condition value/f= 0.939, |f2/f|=0.316, {(N1+N3) /2}-N 2= 0.123, {(nu1+nu3) /2}-nu2=17.7 dT/f=0.261 .
[0027] Example 4f=78.3, F/No=5.6, m= 0.22, omega= 19.2, Y=152.4i ri di j Nj nuj 1 23.599 8.96 1 1.73742 51.052 32.339 1.5723 -32.486 1.0 2 1.65223 33.844 26.822 1.1855 45.619 5.827 3 1.79195 47.496 -31.292 86.4 7 infinity1.0 4 1.51633 64.148 infinity The location of drawing: Image side of the 4th lens side Location of 0.871mm.
[0028] The value f1 of a condition value/f= 1.054, |f2/f|=0.286, {(N1+N3) /2}-N 2= 0.112, {(nu1+nu3) /2}-nu2=15.4 dT/f=0.237 .
[0029] Example 5f=78.3, F/No=5.6, m= 0.22, omega= 19.4, Y=152.4i ri di j Nj nuj 1 23.349 8.85 1 1.73739 51.492 31.996 1.5803 -32.965 1.0 2 1.65223 33.8 4 26.575 1.215 45.460 5.8 3 1.7919647.386 -31.600 86.4 7 infinity1.0 4 1.51633 64.148 infinity The location of drawing: Image side of the 4th lens side Location of 0.871mm.
[0030] The value f1 of a condition value/f= 1.043, |f2/f|=0.286, {(N1+N3) /2}-N 2= 0.112, {(nu1+nu3) /2}-nu2=15.6 dT/f=0.236 .
[0031] As mentioned above, examples 3-5 are examples of claim 3 and the lens for color copy reading of four publications.
[0032] Aberration drawing about the above-mentioned examples 1-5 is shown in drawing 3 - drawing 7 one by one. In these aberration drawing, it is shown that ******** is a thing about e line (wavelength: 546.07nm), C line (wavelength: 656.27nm), an F line (wavelength: 486.13nm), and g line (wavelength: 435.83nm), respectively. Moreover, the continuous line in drawing of astigmatism shows a sagittal ray, and a dashed line shows a meridional beam of light.
[0033] As for each example, chromatic aberration is amended good, although the aberration balance besides a shaft top and a shaft is good and aperture efficiency is 100% of abbreviation, the coma flare is also small and comatic aberration has good and high contrast.
[0034]
[Effect of the Invention] As explained above, according to this invention, the new lens for color

copy reading can be offered. Since there are little three three groups configuration and configuration number of sheets, it can realize small and cheaply, moreover, chromatic aberration is amended good, and since the engine performance is good, this lens can be used suitable for the color copy reader using the three-line 1 chip CCD.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the lens configuration of claim 1 and the lens for color copy reading of two publications.
[Drawing 2] It is drawing showing the lens configuration of claim 3 and the lens for color copy reading of four publications.
[Drawing 3] It is aberration drawing about an example 1.
[Drawing 4] It is aberration drawing about an example 2.
[Drawing 5] It is aberration drawing about an example 3.
[Drawing 6] It is aberration drawing about an example 4.
[Drawing 7] It is aberration drawing about an example 5.
[Description of Notations]
1 Convex Meniscus Lens of 1st Group
2 Biconcave Lens of 2nd Group
3 Biconvex Lens of 3rd Group
4 Drawing

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)**公開特許公報**（Ａ）　(11)特許出願公開番号

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Ｇ０２Ｂ　13/24		9120－2K		

審査請求　未請求　請求項の数４　ＯＬ　（全８頁）

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(22)出願日　平成５年(1993)８月18日

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(54)【発明の名称】　カラー原稿読取用レンズ

(57)【要約】

【目的】小型・低価格で色収差を良好に補正した新規なカラー原稿読取用レンズを実現する。

【構成】物体側から像側へ向かって順次、第１ないし第３群を配してなり、第１，第２群間に絞り４を有する３群３枚構成であり、第１群１は凸面を物体側に向けた凸メニスカスレンズ、第２群２は両凹レンズ、第３群３は両凸レンズであって、ｅ線に対する、全系及び第１，第２群の焦点距離：ｆ，f_1，f_2、第ｊ群（ｊ＝１～３）の材質の屈折率：N_j，アッベ数：ν_jが、条件

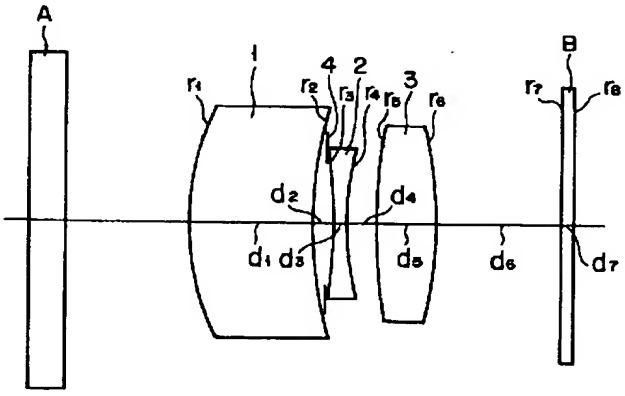
（１）　０．８３＜f_1/f＜０．８８

（２）　０．３０＜｜f_2/f｜＜０．３３

（３）　０．１０＜｛(N_1+N_3)／２｝－N_2＜０．１３

（４）　１６＜｛($\nu_1+\nu_3$)／２｝－ν_2＜１８

を満足する。



【特許請求の範囲】
【請求項１】物体側から像側へ向かって順次、第１ないし第３群を配してなり、第１，第２群間に絞りを有する３群３枚構成であり、
第１群は凸面を物体側に向けた凸メニスカスレンズ、
第２群は両凹レンズ、
第３群は両凸レンズであって、
ｅ線に対する、全系及び第１，第２群の焦点距離：ｆ，f_1，f_2、第ｊ群（ｊ＝１～３）の材質の屈折率：N_j，アッベ数：ν_jが、条件
（１）　０．８３＜f_1／ｆ＜０．８８
（２）　０．３０＜｜f_2／ｆ｜＜０．３３
（３）　０．１０＜｛(N_1＋N_3)／２｝－N_2＜０．１３
（４）　１６＜｛(ν_1＋ν_3)／２｝－ν_2＜１８
を満足することを特徴とするカラー原稿読取用レンズ。
【請求項２】請求項１記載のカラー原稿読取用レンズにおいて、
レンズ系全長：d_Tと、ｅ線に対する全系の合成焦点距離：ｆとが、条件
（５）　０．２５＜d_T／ｆ＜０．２６
を満足することを特徴とするカラー原稿読取用レンズ。
【請求項３】物体側から像側へ向かって順次、第１ないし第３群を配してなり、第２，第３群間に絞りを有する３群３枚構成であり、
第１群は凸面を物体側に向けた凸メニスカスレンズ、
第２群は両凹レンズ、
第３群は両凸レンズであって、
ｅ線に対する、全系及び第１，第２群の焦点距離：ｆ，f_1，f_2、第ｊ群（ｊ＝１～３）の材質の屈折率：N_j，アッベ数：ν_jが、条件
（１’）　０．９３＜f_1／ｆ＜１．０６
（２’）　０．２８＜｜f_2／ｆ｜＜０．３２
（３’）　０．１１＜｛(N_1＋N_3)／２｝－N_2＜０．１３
（４’）　１５＜｛(ν_1＋ν_3)／２｝－ν_2＜１８
を満足することを特徴とするカラー原稿読取用レンズ。
【請求項４】請求項３記載のカラー原稿読取用レンズにおいて、
レンズ系全長：d_Tと、ｅ線に対する全系の合成焦点距離：ｆとが、条件
（５’）　０．２３＜d_T／ｆ＜０．２７
を満足することを特徴とするカラー原稿読取用レンズ。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】この発明はカラー原稿読取用レンズに関する。
【０００２】
【従来の技術】原稿を固体撮像素子により信号化する「原稿読取り」は、従来からファクシミリ装置やデジタル複写機等において広く行われている。近来、これら装置の小型・低価格化が意図されるに伴い、原稿読取りに用いられる原稿読取用レンズも小型・低価格のものが求められている。
【０００３】また、カラー原稿を色分解して読取るのに、赤・緑・青のフィルタを持った固体撮像素子を１チップ上に３ライン併設した「３ライン１チップＣＣＤ」が一般に用いられるが、このような素子でカラー原稿の読取りを行うには、原稿読取用レンズの色収差を良好に補正し、赤・緑・青の各光の最良の結像面を素子受光面に一致させねばならない。
【０００４】レンズ系の小型化・低コスト化に有効な「トリプレット型」で構成した原稿読取用レンズとして、例えば、特開平４－２５５８１４号公報記載のものが知られているが、このレンズは色収差に就いて考慮されておらず、従ってカラー原稿の読取りには適していない。
【０００５】
【発明が解決しようとする課題】この発明は、上述した事情に鑑みてなされたものであって、小型・低価格で色収差を良好に補正した新規なカラー原稿読取用レンズの提供を目的としている。
【０００６】
【課題を解決するための手段】請求項１記載のカラー原稿読取用レンズは、図１に示すようにトリプレット型であって、物体側から像側へ向かって順次、第１群１ないし第３群３を配してなり、第１群１と第２群２との間に絞り４を有する。第１群１は凸面を物体側に向けた凸メニスカスレンズ、第２群２は両凹レンズ、第３群３は両凸レンズである。
第１群１の焦点距離：f_1、第２群２の焦点距離：f_2、全系の焦点距離（合成焦点距離）：ｆ、第ｊ群（ｊ＝１～３）の材質の屈折率：N_j、アッベ数：ν_jは、条件
（１）　０．８３＜f_1／ｆ＜０．８８
（２）　０．３０＜｜f_2／ｆ｜＜０．３３
（３）　０．１０＜｛(N_1＋N_3)／２｝－N_2＜０．１３
（４）　１６＜｛(ν_1＋ν_3)／２｝－ν_2＜１８
を満足する。但し、上記f_1，f_2，ｆ，N_j，ν_jは、全て「ｅ線」に対する値である。
【０００７】上記請求項１記載のカラー原稿読取用レンズにおいては、レンズ系全長：d_Tと、ｅ線に対する全系の合成焦点距離：ｆとが、条件
（５）　０．２５＜d_T／ｆ＜０．２６
を満足することが好ましい（請求項２）。
【０００８】請求項３記載のカラー原稿読取用レンズは、図２に示すようにトリプレット型であって、物体側から像側へ向かって順次、第１群１ないし第３群３を配してなり、第２群２と第３群３との間に絞り４を有す

る。第１群１は凸面を物体側に向けた凸メニスカスレンズ、第２群２は両凹レンズ、第３群３は両凸レンズである。第１群１の焦点距離，第２群２の焦点距離，全系の合成焦点距離，第ｊ群の材質の屈折率，アッベ数を、請求項１におけると同じく、「ｅ線」に対し、それぞれf_1，f_2，ｆ，N_j，ν_jとすると、これらは、条件

（１’）　　０．９３＜f_1／ｆ＜１．０６

（２’）　　０．２８＜｜f_2／ｆ｜＜０．３２

（３’）　　０．１１＜｛(N_1＋N_3)／２｝－N_2＜０．１３

（４’）　　１５＜｛(ν_1＋ν_3)／２｝－ν_2＜１８

を満足する。

【０００９】請求項３記載のカラー原稿読取用レンズにおいては、レンズ系全長：d_Tと、ｅ線に対する全系の合成焦点距離：ｆとが、条件

（５’）　　０．２３＜d_T／ｆ＜０．２７

を満足することが好ましい。

【００１０】なお、図１，２において、符号Ａは原稿載置ガラス、符号Ｂは固体撮像素子の受光面上のカバーガラスを示す。

【００１１】

【作用】この発明のカラー原稿読取用レンズは、上記のように、３群３枚の「トリプレット型」である。請求項１，２記載のカラー原稿読取用レンズと、請求項３，４記載のカラー原稿読取用レンズとは「絞り」の位置が互いに異なり、この違いに応じて、各条件式におけるパラメータ：f_1／ｆ，｜f_2／ｆ｜，｛(N_1＋N_3)／２｝－N_2，｛(ν_1＋ν_3)／２｝－ν_2，d_T／ｆの範囲が若干異なったものとなっている。

【００１２】条件（１），（１’）は、請求項１，３記載のカラー原稿読取用レンズのそれぞれにおいて「第１群のパワーを定める条件」であり、これら条件の上限を超えると、第１群の正のパワーが小さくなり過ぎるため、レンズ全長が大きくなり原稿読取装置の小型化の要請に沿うことが困難になる。逆に下限を超えると、第１群の正のパワーが大きくなり、レンズ全長のコンパクト化には有利であるが、歪曲収差・コマ収差が悪化し、収差補正が困難となる。

【００１３】条件（２），（２’）は、請求項１，３記載のカラー原稿読取用レンズのそれぞれにおいて「第２群のパワーを定める条件」であり、これら条件の上限を超えると、第２群の負のパワーが小さくなり過ぎるためペッツバール和が大きくなって非点収差の補正が困難になる。下限を超えると、各レンズのパワーが大きくなって高次収差が発生し易くなり、コマ収差が発生する。

【００１４】条件（３），（３’）は、請求項１，３記載のカラー原稿読取用レンズのそれぞれにおいて「凸・凹レンズの屈折率の関係を定める条件」であり、これら条件の上限を超えると、ペッツバール和が小さくなり過ぎ、像面が正の側に倒れて像面湾曲が大きくなる。下限を超えると、ペッツバール和が大きくなり過ぎ、像面が負の側に倒れ、非点隔差が大きくなり。従って、条件（３），（３’）の範囲外では全面各にわたって良好な性能を得ることができない。

【００１５】条件（４），（４’）は、請求項１，３記載のカラー原稿読取用レンズのそれぞれにおいて「色収差を良好に補正するための条件」であって、上限を超えると軸上の色収差が補正過剰となり、主波長に対して短波長側の軸上の色収差が正で大きくなる。また下限を超えると、主波長に対して短波長側の軸上の色収差が負で大きくなる。

【００１６】条件（５），（５’）は、請求項１，３記載の各カラー原稿読取用レンズに対する付加的な条件であり、請求項１，３記載の各カラー原稿読取用レンズはそれぞれ条件（５），（５’）を満足することが好ましい。

【００１７】即ち、条件（５），（５’）は全長に関する条件であって、これらの条件を満足することにより、請求項１，３記載の各カラー原稿読取用レンズの特徴を活かしつつ、さらに収差を良好に補正して全長のコンパクト化が可能となる。

【００１８】

【実施例】以下、具体的な実施例を挙げる。

【００１９】図１および２に示すように、物体側から数えて第ｉ番目のレンズ面およびカバーガラスＢの各面の曲率半径をr_i（ｉ＝１～８）とし、物体側から数えて第ｉ番目の面と第ｉ＋１番目の面の光軸上の面間隔をd_i（ｉ＝１～７）とする。また、第ｊ群（Ｊ＝ｊ～３）の材質のｅ線に対する屈折率とアッベ数をN_j，ν_j、カバーガラスＢの屈折率とアッベ数を上記サフィックスｊ＝４としてN_4，ν_4と表示する。さらに、全系の合成焦点距離をｆ（単位：ｍｍ）、明るさをＦ／Ｎｏ、倍率をｍ、半画角をω（単位：度）、物体高をＹ（単位：ｍｍ）で表す。なお、原稿載置ガラスＡはレンズ性能に影響しないので元の記載を省略する。

【００２０】実施例１

ｆ＝７８．３，Ｆ／Ｎｏ＝５．６，ｍ＝０．２２，ω＝１９．２，Ｙ＝１５２．４

ｉ	r_i	d_i
１	２４．３６３	１０．０００
２	３６．７５７	１．４１２
３	－４０．５９３	１．０
４	２７．３１４	１．８９０

ｊ	N_j	ν_j
１	１．７７６２１	４９．６２
２	１．６７７６５	３２．１７

5	55.614	6.006
6	−34.893	86.4
7	∞	1.0
8	∞	

絞りの位置：第２レンズ面の像側　０．９１１ｍｍの位置。

【００２１】条件値の値

$f_1/f=0.879$，$|f_2/f|=0.307$，$\{(N_1+N_3)/2\}-N_2=0.106$，$\{(\nu_1+\nu_3)/2\}-\nu_2=16.4$

i	r_i	d_i
1	24.143	10.000
2	38.631	1.702
3	−41.369	1.0
4	26.499	2.445
5	59.329	4.803
6	−35.371	86.4
7	∞	1.0
8	∞	

絞りの位置：第２レンズ面の像側　１．２０９ｍｍの位置。

【００２３】条件値の値

$f_1/f=0.835$，$|f_2/f|=0.321$，$\{(N_1+N_3)/2\}-N_2=0.120$，$\{(\nu_1+\nu_3)/2\}-\nu_2=18.0$ $d_T/f=0.255$

i	r_i	d_i
1	23.389	10.000
2	34.573	1.374
3	−39.618	1.0
4	25.523	1.795
5	49.495	6.232
6	−36.344	86.4
7	∞	1.0
8	∞	

絞りの位置：第４レンズ面の像側　０．８５７ｍｍの位置。

【００２６】条件値の値

$f_1/f=0.939$，$|f_2/f|=0.316$，$\{(N_1+N_3)/2\}-N_2=0.123$，$\{(\nu_1+\nu_3)/2\}-\nu_2=17.7$

i	r_i	d_i
1	23.599	8.96
2	32.339	1.572
3	−32.486	1.0
4	26.822	1.185
5	45.619	5.827
6	−31.292	86.4
7	∞	1.0
8	∞	

絞りの位置：第４レンズ面の像側　０．８７１ｍｍの位置。

j	N_j	ν_j
1	1.75844	52.30
2	1.63923	32.48
3	1.76066	48.67
4	1.51633	64.14

$d_T/f=0.259$

【００２２】実施例２

$f=78.3$，$F/No=5.6$，$m=0.22$，$\omega=19.2$，$Y=152.4$

j	N_j	ν_j
1	1.75844	52.30
2	1.63923	32.48
3	1.79195	47.49
4	1.51633	64.14

$d_T/f=0.259$

【００２４】以上、実施例１，２は請求項１，２記載のカラー原稿読取用レンズの実施例である。

【００２５】実施例３

$f=78.3$，$F/No=5.6$，$m=0.22$，$\omega=19.1$，$Y=152.4$

j	N_j	ν_j
1	1.71615	53.94
2	1.62270	34.06
3	1.77621	49.62
4	1.51633	64.14

$d_T/f=0.261$

【００２７】実施例４

$f=78.3$，$F/No=5.6$，$m=0.22$，$\omega=19.2$，$Y=152.4$

j	N_j	ν_j
1	1.73742	51.05
2	1.65223	33.84
3	1.79195	47.49
4	1.51633	64.14

置。

【００２８】条件値の値

$f_1/f=1.054$，$|f_2/f|=0.286$，$\{(N_1+N_3)/2\}-N_2=0.112$，$\{(\nu_1+\nu_3)/2\}-\nu_2=15.4$

$d_T/f=0.237$

i	r_i	d_i
1	23.349	8.85
2	31.996	1.580
3	−32.965	1.0
4	26.575	1.21
5	45.460	5.8
6	−31.600	86.4
7	∞	1.0
8	∞	

j	N_j	ν_j
1	1.73739	51.49
2	1.65223	33.8
3	1.79196	47.38
4	1.51633	64.14

絞りの位置：第４レンズ面の像側　０．８７１ｍｍの位置。

【００３０】条件値の値

$f_1/f=1.043$，$|f_2/f|=0.286$，$\{(N_1+N_3)/2\}-N_2=0.112$，$\{(\nu_1+\nu_3)/2\}-\nu_2=15.6$

$d_T/f=0.236$

【００３１】以上、実施例３～５は請求項３，４記載のカラー原稿読取用レンズの実施例である。

【００３２】図３～図７に順次、上記実施例１～５に関する収差図を示す。これら収差図において、①②③④はそれぞれ、ｅ線（波長：５４６．０７ｎｍ），Ｃ線（波長：６５６．２７ｎｍ），Ｆ線（波長：４８６．１３ｎｍ），ｇ線（波長：４３５．８３ｎｍ）に関するものであることを示す。また非点収差の図における実線はサジタル光線、破線はメリディオナル光線を示す。

【００３３】各実施例とも色収差が良好に補正され、軸上・軸外の収差バランスが良く、開口効率が略１００％であるにも拘らず、コマフレアも小さく、コマ収差が良好で高いコントラストを有している。

【００３４】

【００２９】実施例５

$f=78.3$，$F/No=5.6$，$m=0.22$，$\omega=19.4$，$Y=152.4$

【発明の効果】以上説明したように、この発明によれば新規なカラー原稿読取用レンズを提供できる。このレンズは３群３枚構成と構成枚数が少ないため小型・安価に実現でき、しかも色収差が良好に補正され、性能良好であるから３ライン１チップＣＣＤを用いるカラー原稿読取装置に好適に利用できる。

【図面の簡単な説明】

【図１】請求項１，２記載のカラー原稿読取用レンズのレンズ構成を示す図である。

【図２】請求項３，４記載のカラー原稿読取用レンズのレンズ構成を示す図である。

【図３】実施例１に関する収差図である。

【図４】実施例２に関する収差図である。

【図５】実施例３に関する収差図である。

【図６】実施例４に関する収差図である。

【図７】実施例５に関する収差図である。

【符号の説明】

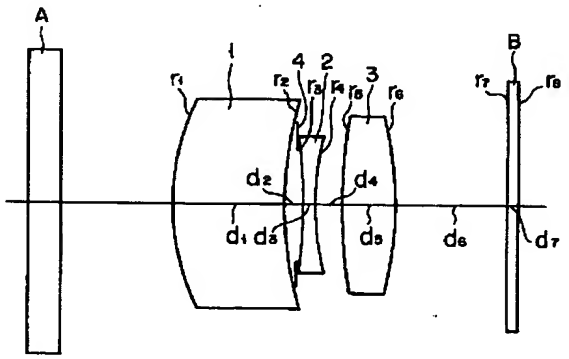
1　第１群の凸メニスカスレンズ

2　第２群の両凹レンズ

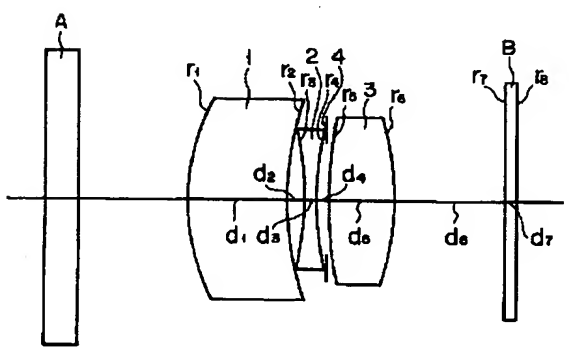
3　第３群の両凸レンズ

4　絞り

【図１】

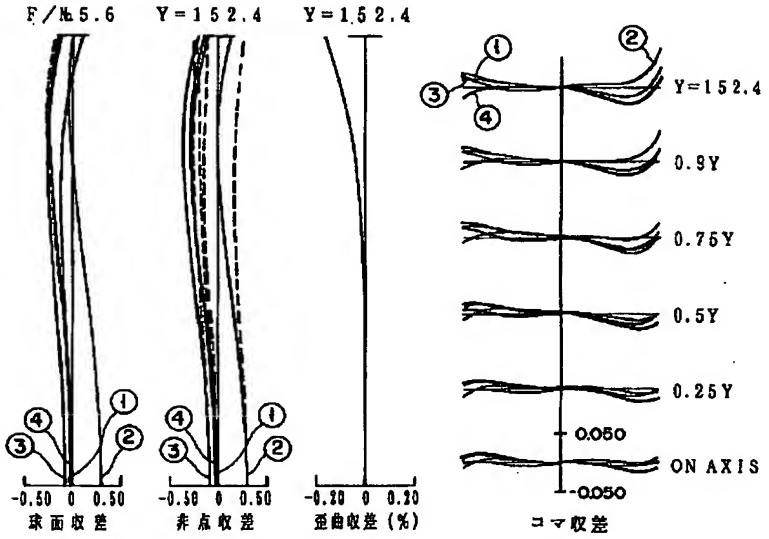


【図２】



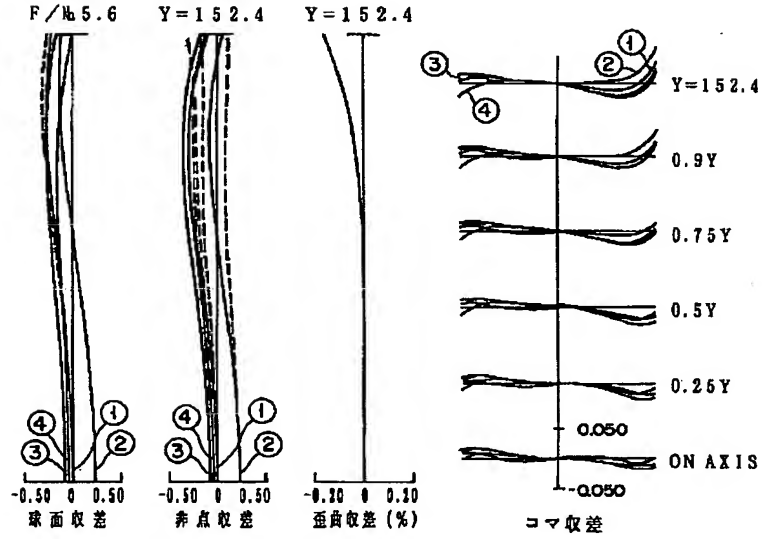
【図３】

（実施例１）



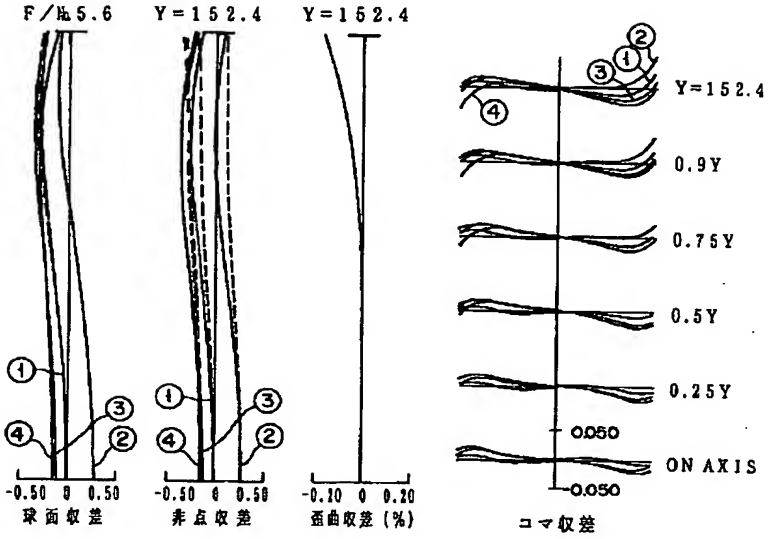
【図４】

（実施例２）



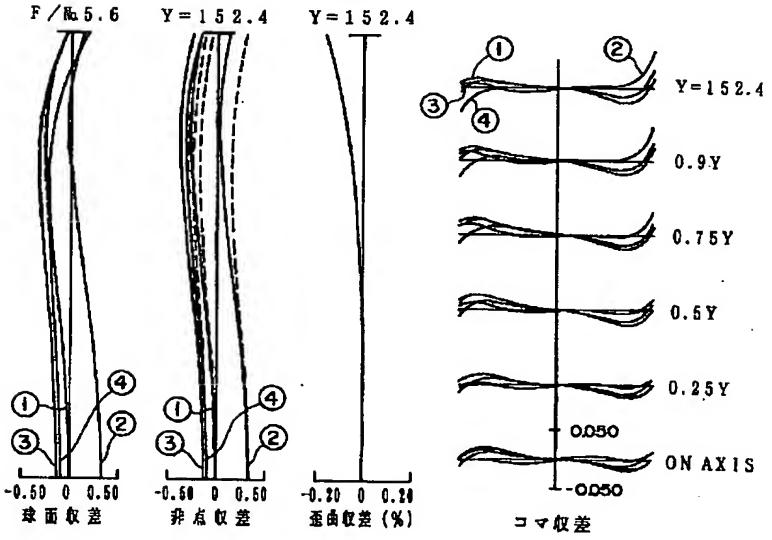
【図５】

（実施例３）



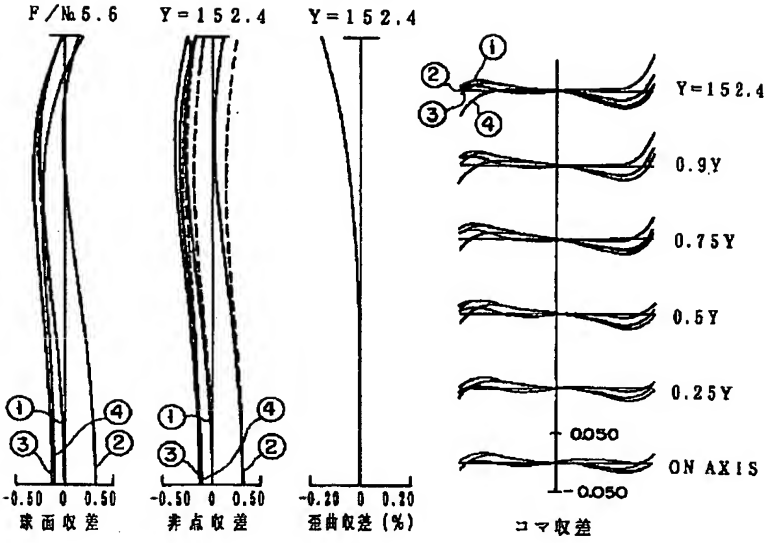
【図６】

（実施例４）



【図７】

（実施例５）


F/No.5.6
Y=152.4
Y=152.4
-0.50 0 0.50
球面収差
-0.50 0 0.50
非点収差
-0.20 0 0.20
歪曲収差（%）
Y=152.4
0.9Y
0.75Y
0.5Y
0.25Y
0.050
ON AXIS
0.050
コマ収差